Small Business Innovation Research/Small Business Tech Transfer

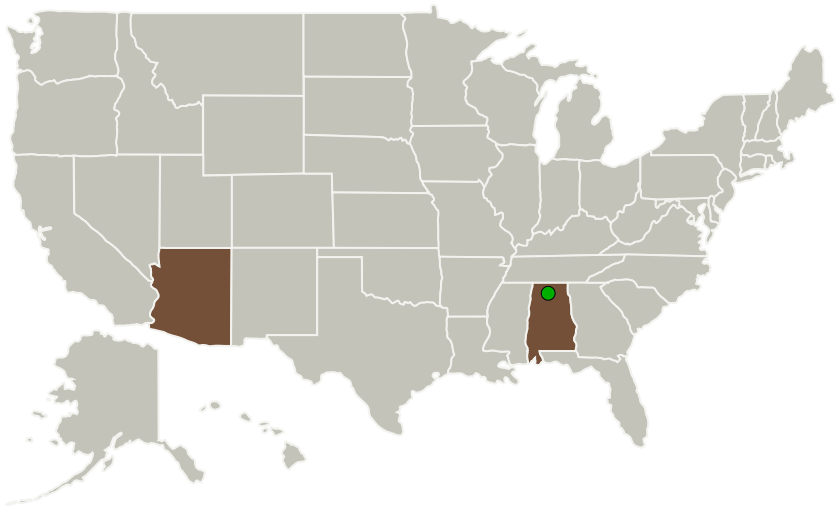
Study of Sensitivity Enhancement and Dead Band Elimination in Laser Gyros, Phase I

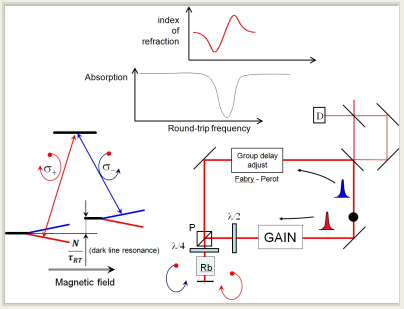
Completed Technology Project (2015 - 2015)

Project Introduction

The essential elements that characterize the performance of a laser gyro are (a) a bidirectional ring laser, (b) a lightweight, efficient instrument (c) a high sensitivity to rotation and (d) a linear response without dead band. To address (c), substantial enhancement has been predicted through large intracavity (normal) dispersion dn/df. The objective of Phase I is to demonstrate experimentally this enhancement, in combination with demonstrating the absence of dead band (d) in a solid state laser. A key element is the realization that it is possible to engineer a mode-locked laser where the pulse envelope velocity is controlled by other parameters than the dispersion. We have demonstrated this property in a mode-locked laser with intracavity Fabry-Perot and with intracavity resonant atomic vapor. This property will be exploited in Phase I by inserting in a ring mode-locked Ti:sapphire laser a Fabry-Perot and a Rubidium cell, to demonstrate simultaneously the enhancement of the gyro sensitivity, the use of a solid state gain medium in a gyro, and the absence of dead band. In Phase II, these results will be implemented in a mode-locked fiber laser gyro, to demonstrate the light and efficient instrument required for space applications.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Lenzner Research, LLC	Lead Organization	Industry	Tucson, Arizona
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Arizona

Project Transitions

June 2015: Project Start

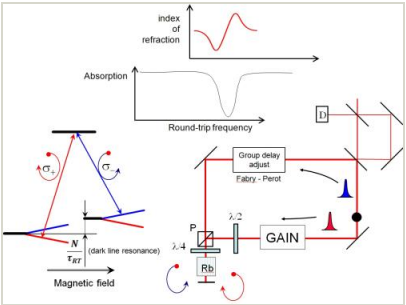
December 2015: Closed out

Closeout Summary: Study of sensitivity enhancement and dead band eliminati on in laser gyros, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/141185)*

Images



Briefing Chart Image
Study of sensitivity enhancement and dead band elimination in laser gyros, Phase I *(https://techport.nasa.gov/image/136805)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Lenzner Research, LLC

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

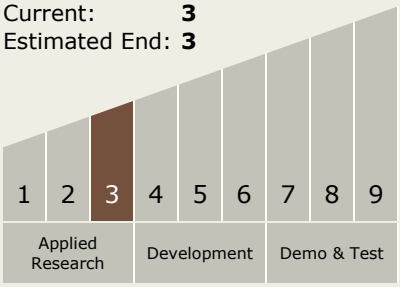
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Matthias H Lenzner

Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX17 Guidance, Navigation, and Control (GN&C)
  - TX17.2 Navigation Technologies
    - TX17.2.3 Navigation Sensors

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System